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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/783,498	02/20/2004	Li-Shyue Lai	TSM03-0199	7579

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EXAMINER	
CAO, PHAT X	

ART UNIT	PAPER NUMBER
2814	

DATE MAILED: 10/04/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/783,498	LAI ET AL.	
	Examiner	Art Unit	
	Phat X. Cao	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 July 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5,7-11 and 29-38* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *9-11* is/are allowed.

6)☒ Claim(s) *1-5,7,8,29-38* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

2. Claims 1-5, 29-33, and 35-38 are rejected under 35 U.S.C. 102(e) as being anticipated by Lee et al (US. 6,806,528).

Regarding claims 1, 29 and 30, Lee (Fig. 3A) discloses a phase change memory cell fabricated on a semiconductor substrate 100 comprising: an insulating dielectric layer 250; a thin conductive film 260a having a first film thickness on the dielectric layer 250, the plane of the film 260a being generally parallel to the plane of the dielectric layer 250; a layer of a phase change material 300a (column 9, line 1) having a second film thickness supported by the dielectric layer 250, wherein the phase change material 300a and the thin conductive film 260a are not relatively superjacent; an

electrically resistive interface 270a between the thin conductive film 260a and the phase change material layer 300a, the interface 270a being defined by an area of engagement between the film 260a and the layer 300a that is generally normal to the plane of the dielectric layer 250, and wherein the thickness of the thin conductive film 260a is less than the thickness of the layer of phase change material 300a at the interface; and an electrode 360 (i.e., bit line) superjacent to the phase change material layer 300a (Fig. 3A) and electrically coupled with the phase change material 360a (see equivalent circuit in Fig. 4).

Regarding claims 2-3, 5, 33 and 35, Lee's Fig. 3A further discloses that the width of the conductive film 260a generally parallel to the plane of the dielectric layer 250 and the height of the conductive film 260a generally normal to the plane of the dielectric layer 250 determine the area of engagement (claims 2-3 and 35). Therefore, the current path from the interface into the phase change material layer 300a inherently lies in a direction substantially parallel to the plane of the substrate, and the current path from the phase change material layer 300a into the contact (260b,340) inherently lies in a direction generally normal to the plane of the substrate (claims 5 and 33).

It is noted that the electrical resistance of the interface is inversely proportional to the area of engagement (claims 2) because the conductive resistance is inversely proportional to the conductive area. It is also noted that the process limitations recited in a "product by process" claims 3 and 35 (determined by photolithography, by deposition parameters) would not carry patentable weight in a claim drawn to structure

because distinct structure is not necessarily produced. In re Thorpe, 227 USPQ 964 (Fed. Cir. 1985).

Regarding claims 4 and 32, because the width of the conductive film 260a is parallel to the plane of the substrate, the heat produced by current through the interface 270a would also flow from the interface 270a into the phase change material layer 300a in a direction parallel to the plane of the substrate.

Regarding claims 6 and 31, Lee's Fig. 3A further discloses that the phase change material layer 300a and the thin conductive film 260a are not relatively superjacent or subjacent, and the conductive material 260a comprises a high band gap and high thermal conductivity material of titanium nitride (column 11, lines 41-45).

Regarding claim 36, Lee (Fig. 3A) discloses a memory cell, comprising: a layer of phase change material 300a; and an elongated thin conductive film 260a having one end engaging a side of the layer 300a to define an interface 270a having a width and a height, wherein the thin conductive film and the layer of the phase change material engage at an interface and wherein the thin conductive film 260a has a thickness at the interface that is thinner than the phase change material 300a at the interface. It is also noted that the process limitations recited in a "product by process" claim (determined non-photolithographically, by thin film deposition parameters)) would not carry patentable weight in a claim drawn to structure because distinct structure is not necessarily produced. In re Thorpe, 227 USPQ 964 (Fed. Cir. 1985).

Regarding claims 37-38, because the width of the conductive film 260a generally parallel to the plane of the substrate and the height of the contact (260b,340) generally

normal to the film 260a, the current flows from the interface into the phase change material layer 300a generally parallel to the film 260a and the current flows out of the layer 300a into the contact (260b,340) generally normal to the film 260a.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 7-8 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al (US. 6,806,528) in view of Ha et al (previously cited in IDS).

Regarding claims 7 and 34, Lee does not disclose that the phase change material layer 300a resides in a trench formed in the dielectric layer 250.

However, Ha (Fig. 1b) teaches the forming of a phase change material GST residing in a trench formed in the dielectric layer ILD. Accordingly, it would have been obvious to modify the memory cell of Lee by forming the phase change material layer 300a within a trench formed in the dielectric layer 250 because such forming of the phase change material layer would provide the memory cell having a compact structure, as taught by Ha (see abstract paragraph).

Regarding claim 8, Lee's Fig. 3A further discloses that a transistor 120 is formed in and on the substrate 100 and in the dielectric layer 250, and wherein an output of transistor 140 of transistor is electrically continuous with one terminus of the thin

conductive film 260a, the other terminus of the thin conductive film 260a engaging the dielectric layer 250 to define the interface.

Allowable Subject Matter

5. Claims 9-11 are allowed.

See reasons of record.

Response to Arguments

6. Applicant argues that Lee does not suggest "an electrode superjacent to the phase change material layer" as amended.

This argument is not persuasive because Lee does suggest a bit line (BL) electrode 360 superjacent to the phase change material layer 300a (see Fig. 3A) and electrically connected with one end of the phase change material layer Rc (see circuit connections in Fig. 4).

Conclusion

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Phat X. Cao whose telephone number is 571-272-1703. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on 571-272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

PC
September 28, 2006

PHAT X. CAO
PRIMARY EXAMINER